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Abstract

PROGRESS TOWARDS A STANDARD DESIGN OF A.G.R. FUEL ELEMENTS FOR POWER REACTORS

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The advantages to be gained from the standardisation of fuel elements for a large number of reactors include savings in fabrication costs due to unification of manufacturing plant, savings in development costs due to these being shared, and savings in the design and development costs of the reactor plant, due to the further standardisation possible both in components and design treatment. The results of continuing fuel development can be applied to improve the current standard design and are enhanced in value by being directly applicable in new fuel charges for existing, as well as future, reactors of the type. With the A.G.R. concept, such standardisation is possible over a wide range of reactor sizes.

The design and development programme on A.G.R. fuel assemblies is aimed at the formulation of such a standard concept for power reactor fuel elements, taking the original Windscale A.G.R. fuel design as the starting point. The basis for the selection of parameters and structural design features is discussed including a brief outline of a method for estimating the variations of the can temperature from the nominal in particular cluster designs. A synopsis is given of the data selected as most appropriate for the calculation of gaseous fission products within the can under A.G.R. conditions, this influences the chosen reactor conditions.

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Out-of-pile work undertaken to sort out the likely behaviour of fuel elements and assemblies is described. It includes data on the conditions critical for the appearance of longitudinal wrinkles during creep collapse, and on the behaviour of cans under simulated fault conditions. The behaviour of different assembly designs during thermal cycling is discussed. A few notes are included on the effect of dropping assemblies.

The fuel element irradiation programme in W.A.G.R. is described. The correlation of the performance of those already in the reactor with that expected is discussed. A brief description is given of the facilities available for the examination of irradiated elements. The results from the post-irradiation examination of fuel element stringers from W.A.G.R., as well as from certain loop experiments undertaken in NRX under conditions similar to A.G.R., are discussed. The data covers particularly length changes occurring in-pile, fission product gas release and an unusual chemical attack on the inside surfaces of the stainless steel cans.